

Liquid Crystal (LC)

Measured values

- Wall temperature

Principle

Thermochromic liquid crystals (LC) are used for visualization of the surface temperature distribution of streamlined bodies / profiles. Compared to measurement processes in which a temperature difference between outer flow and the model is produced and thereby the surface temperature influenced by heat flow is determined, a constant ambient temperature (without heat flux) the adiabatic wall temperature can be determined. It is advantageous to thermally isolate the model. By accurately adjusting of the total temperature of the wind tunnel the adiabatic wall temperature on profile can be displayed within the measurement range of the liquid crystal. Its color changes with increasing temperature over a spectrum from red to blue. Since the color changes are reversible, low frequency non-steady state changes can be made continuously visible.

Simple determination of the qualitative temperature distribution. For quantitative measurements, calibrations would be required. Temperature ranges of 305 - 310 K, for example, resolution 0.1 - 0.5 degrees.

Application

visualization

- of the boundary layer transition from laminar to turbulent
- of laminar boundary layer separation and separation with turbulent reattachment
- in the field of shock boundary layer interference
- of low frequency transient changes in wall temperature

Literature / References

- [1] Steinert, W., and Starcken, H., 1996, "Off-Design Transition and Separation Behavior of a CDA Cascade," ASME Journal of Turbomachinery,, Vol.118, No 2, pp. 204-210.
- [2] Schreiber, H.A., Steinert, W., and Kuesters, B., 2002, "Effect of Reynolds Number and Free-Stream Turbulence on Boundary Layer Transition in a Compressor Cascade," ASME Journal of Turbomachinery, Vol. 124, No. 1, pp. 1-9.
- [3] Bize, D., Lempereur, C., Mathe, J. M., Mignosi, A., Seraudie, A., Serrot, G., 1998, "Transition analysis by surface temperature mapping using liquid crystals," Aerospace Science and Technology, Paris, No. 7, pp. 439-449

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This handout, and cross-references to related measurement techniques and facilities are available at: <http://messtec.dlr.de/link-73-en>.

Visualization of the transition on a compressor profile

